Description of the Patent of Invention for "Wave Energy Plant for Electricity Generation"

Technical Field

The proposal concept deals with an ocean wave energy plant for electricity generation. It is composed by several components such as floaters, hydraulic pumps, hyperbaric chambers, outflow regulating valve, hydraulic turbine and electric generator.

Previous Technics

In the year of 1799 in France, the wave energy was employed directly to drive pumps, mills and other heavy mechanisms. Since then, experiences with different concepts have been performed worldwide.

Following the oil crisis of the 70's, the scientific research has had a significant increment in extracting increased amounts of electricity from wave energy, particularly in Europe.

Currently the electricity produced through the ocean wave energy is already treated commercially in a few cases. Some examples are: Netherlands with the project AWS (Archimedes Wave Swing) with 2MW of power, Portugal with the project OWC (Oscillating Water Column) with 400kW of power and the United Kingdom with the project LIMPET with 500 kW of power. In Denmark it is in installation tests the project WAVE DRAGON, with power generation up to 4MW.

The United States, Canada, Australia, Ireland, Norway, New Zealand, Spain, Sweden, Greece, India, China, Korea and Japan are examples of countries that have been working in research and development on ocean wave energy.

The concept of the proposed plant differs from the others considering that it incorporates hyperbaric chambers operating in high pressure up to 2500 psi or 17MPa

the wave length to avoid sea bottom effects. The plant can also be installed floating in water depths greater than 35 meters (offshore system).

Process and Operational Parameters

The plant power generation is given by the product of the outflow to move the turbine and the pressure supplied by the hyperbaric chamber during the operation. This pressure in a conventional hydroelectric plant is provided by the outflow from the waterfall height (potential energy). The operational pressure range of the plant is associated with the predominant sea conditions in the installation location, such as average frequency and the significative wave height, according to the table below.

Table 1: Relationship between Pressure and Water Column

Pressure (Psi)	Pressure (MPa)	Water column (m)
500	3.5	350
1000	7.0	700
1500	10.5	1050
2000	14.0	1400
2500	17.5	1750

The plant can use either the ocean as a water reservoir or operate in closed circuit with stored fresh water; in this case the water is stored in a water tank.

After pumped into the hyperbaric chambers and stored under high pressure, the water jet is released to move the hydraulic turbine. The outflow of the water is controlled by a high pressure valve, especially designed for power control during the variation of the electricity demand, as well as to stop the plant for maintenance or in an emergency situation.